Puget Sound Naval Shipyard

Mixed Waste Analysis Plan

Attachment CC

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Appendix B – Laboratory Testing and Analytical Methods

Figures and Tables

LIST OF ACRONYMS

ASTM	American Society for Testing and Materials
DOT	Department of Transportation
DW	Dangerous Waste
Ecology	Washington Department of Ecology
EHW	Extremely Hazardous Waste
EPA	Environmental Protection Agency
HOC	Halogenated Organic Compound
DWMU	Dangerous Waste Management Unit
IRR	Inactivation, Recycling, Reactor Compartment Disposal
LDR	Land Disposal Restriction
LLRW	Low Level Radioactive Waste
MEK	Methyl Ethyl Ketone
MSDS	Material Safety Data Sheet
MWAP	Mixed Waste Analysis Plan
MWMP	Mixed Waste Management Plan
MWPP	Mixed Waste Profile Portfolio
MWPR	Mixed Waste Profile Record
MWSF	Mixed Waste Storage Facility
NNPP	Naval Nuclear Propulsion Program
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyls
PPE	Personal Protective Equipment
PSNS	Puget Sound Naval Shipyard
QP	Laboratory Quality Plan
RAMT	Radioactive Material Tag
RWIS	Radioactive Waste Information Sheet
QA/QC	Quality Assurance / Quality Control
RCRA	Resource Conservation and Recovery Act
SAR	Sample Analysis Request
TBG	Treatment by Generator
TCLP	Toxicity Characteristic Leaching Procedure
TSCA	Toxic Substances Control Act
TWD	Technical Work Document
VOC	Volatile Organic Compound
WAC	Washington Administrative Code

Mixed Waste Analysis Plan

1. General

This instruction provides guidance for the analysis of mixed waste at Puget Sound Naval Shipyard (PSNS). PSNS generates small quantities of waste that may have both radioactive constituents and constituents regulated under the Washington State Dangerous Waste Regulations, reference (1). This waste may also be regulated under the Federal Resource Conservation and Recovery Act, reference (2), and/or the Federal Toxic Substances Control Act (for PCBs), reference (3). A written waste analysis plan is used to comply with the requirements of references (1) (section 300) and (2) (Part 270.14). This Mixed Waste Analysis Plan (MWAP) applies only to mixed waste generated by the Naval Nuclear Propulsion Program (NNPP).

1.1 Objectives

The intent of this plan is to specify the methods and parameters used to analyze the mixed waste received or generated by PSNS. The objectives of this MWAP are:

- Identify the constituents and characteristics of a mixed waste that cause the waste to be regulated under reference (1), so the waste can be properly treated, stored, transported, and/or disposed.
- Perform reanalysis on mixed waste streams to verify their characterization.
- Ensure mixed waste is compatible with its storage containers.
- Ensure incompatible wastes are not mixed together.
- Identify sampling and testing procedures for mixed waste analysis.
- Specify the responsibilities of the various organizations performing or assisting in mixed waste analysis.
- Ensure all requirements of the Resource Conservation and Recovery Act (RCRA) and the Washington Department of Ecology (Ecology) regulations for mixed waste analysis are accomplished and documented.
- Identify any applicable Land Disposal Restrictions (LDR) for the waste.
- Ensure all requirements of the Toxic Substances Control Act (TSCA) are accomplished and documented.

1.2 References

(1) Washington Dangerous Waste Regulations, Washington Administrative Code (WAC) 173-303

(2) RCRA Hazardous Waste Regulations, Code of Federal Regulations, Title 40, Parts 260 through 279

(3) Toxic Substances Control Act, Code of Federal Regulations, Title 40, Part 761

(4) NAVSHIPYDPUGETINST P5090.37, Puget Sound Naval Shipyard Code 105.2, Mixed Waste Management Plan. Applicable Nuclear Power Manual chapters incorporating the requirements of P5090.37 may be used in place of P5090.37 when authorized.

(5) PSNS Code 134 Laboratory Division Quality Control Manual, Chapter 8.

(6) Department of Transportation (DOT) Regulations, Code of Federal Regulations, Title 49, Parts 171-177

(7) EPA-600/2-80-076, 1980, A Method of Determining the Compatibility of Hazardous Waste

(8) EPA publication SW-846, latest edition, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods

(9) NAVSHIPYDPUGETINST 4730.54, Puget Sound Naval Shipyard Code 134, Submitting Samples to the Laboratory Division for Analysis or Test

(10) NAVSHIPYDPUGETINST 5090.26A CH-3, Puget Sound Naval Shipyard Code 106, Waste Analysis Plan, latest edition

(11) Treatment by Generator Waste Analysis Plan, Puget Sound Naval Shipyard Code 105.2, latest edition

1.3 Definitions

Batch: Any waste generated less frequently than once a month.[1]

Characterization: The identification and quantification of constituents and properties that cause a waste to be regulated under reference (1) based on data gained from sampling and/or process knowledge.

Common Wastes: Wastes in a particular waste stream for which the waste stream characterization is consistent throughout. These wastes are re- analyzed periodically as a stream.

Container: Any portable device in which a substance or waste is stored, transported, treated, disposed, or otherwise handled.[1]

Dangerous Waste: Solid waste designated by reference (1). Reference (1) may place an additional classification of 'extremely hazardous' on some designated waste. All reference (1) designated waste would be a mixed waste if radioactive constituents are present.[1]

Designation: The process of determining whether a waste is regulated under the dangerous waste lists, characteristics, or criteria given in reference (1).[1]

Disposal: Discharging, discarding, or abandoning of dangerous wastes or the treatment, decontamination, or recycling of such wastes once they have been discarded or abandoned.[1]

Extremely Hazardous waste: A dangerous waste (i.e., solid waste designated by reference (1)), that is further designated by reference (1) as 'extremely hazardous' due to its constituents. This waste would be a mixed waste if radioactive constituents are present.[1]

[1] The term 'hazardous waste' refers to waste designated by reference (2) and should not be confused with 'extremely hazardous waste' from reference (1). Dangerous and Extremely Hazardous waste from reference (1) may or may not be regulated as hazardous waste under reference (2). In some cases, waste that is not a hazardous waste under reference (2) may be a Dangerous Waste under reference (1) and also mixed waste if radioactive constituents are present.

Fingerprint Analysis: An abbreviated waste analysis generally conducted to provide information that will verify the waste received matches the expected characteristics for that waste. The analysis will typically test for specific parameters, such as density, phase, pH, flash point, and total metals, expected to be in the waste based on the provided waste analysis.

Hazardous Waste: Those solid wastes designated by 40 CFR Part 261 and regulated by the United States Environmental Protection Agency (EPA). Reference (1) incorporates and administers the requirements of 40 CFR Part 261 in the State of Washington and designates such waste as either 'dangerous' or 'extremely hazardous'.

Incompatible Waste: Any dangerous waste which is unsuitable for placement in a particular device or facility because it may corrode or decay the containment materials, or it is unsuitable for mixing with another waste or material because the mixture might produce heat or pressure; fire or explosion; violent reaction; toxic dust, fumes, mists, or gases; or flammable fumes or gases. [2]

Land Disposal Restrictions (LDRs): Regulations specified in Part 268 of reference (2) which control wastes that may be land disposed and the standards for treatment prior to disposal.

Mixed Waste: A Dangerous Waste (i.e., designated under reference (1) as either 'dangerous' or 'extremely hazardous') that also contains a radioactive component defined by 10 CFR 20.1003, as source, special nuclear, or by-product material subject to the Atomic Energy Act of 1954.[2]

Originator or Generator: Any person, by site, whose act or process produces dangerous waste or whose act first causes a dangerous waste to become subject to regulation.[2]

Process Knowledge: Determination of the chemical and physical nature of a waste by applying knowledge of the materials or the processes used. Typical sources of process knowledge are vendor information, Material Safety Data Sheets (MSDS's), prior characterizations, drawings, military specifications, work documents, and originating process.

Representative Sample: A sample that exhibits the same properties as the sample source.

Sampling Plan: A plan that specifies the procedural requirements for properly obtaining a representative sample in a given situation.

Spent material: Any material that has been used and as a result of contamination can no longer serve the purpose for which it was produced without processing.

Surrogate Analysis: Analysis based on data obtained from laboratory analysis of similar or chemically identical, non-radioactive wastes. Surrogate analysis is only used if the sample material accurately represents the regulated constituents in the mixed waste (i.e., those constituents regulated under reference (1)).

Toxicity Characteristic Leaching Procedure (TCLP): An Environmental Protection Agency approved laboratory test method to measure the mobility of toxic constituents in a waste.

Treatment by Generator (TBG): A process, such as solidification, performed by the generator in containers or tanks. This process changes the physical characteristics

[2] The source of this definition is reference (1).

or chemical composition of a mixed waste and may result in the waste no longer being considered mixed waste. The waste might meet LDR's after treatment.

Uncommon Wastes: Waste from a stream in which the entire waste stream cannot be consistently characterized. These wastes are analyzed on a batch by batch basis.

Waste Stream: A grouping of wastes based on a single process source, similar physical characteristics, or similar treatment or disposal requirements.

1.4 Responsibilities

1.4.1 Radioactive Waste Management Division, Code 105.2

(a) Ensures that mixed waste is analyzed, reported, and managed in accordance with this instruction and reference (4). Provides engineering support for interface with the EPA, Naval Sea Systems Command (NAVSEA), and Ecology.

(1) Designates mixed waste by applying the RCRA, TSCA, and state of Washington regulations.

(2) Reviews the characterization of mixed waste items.

(3) Reviews and updates this instruction annually or as required to comply with changing requirements and regulations.

(4) Ensures compliance with MWAP and provides waste assessment oversight.

(5) Establishes waste acceptance requirements.

(6) Provides guidance and assistance on preparation of sampling instructions and on waste characterization.

(7) Maintains documentation of waste analyses, characterization, and designation.

(8) Interprets the regulations in regard to mixed waste management. Maintains a file of these regulatory interpretations.

(b) Provides radiological and hazardous waste engineering support for Naval nuclear work involving mixed waste.

(1) Coordinates collection of necessary information for waste analysis review of waste to be received from off-station.

(2) Characterizes mixed waste generated at PSNS.

(3) Directs transfers of mixed waste within the Shipyard.

(4) Provides engineering support and oversight for TBG operations.

(5) Provides engineering support and oversight for processing of mixed waste.

(6) Prepares sampling plans and directs testing to support characterization of mixed waste in their cognizance.

(7) Performs a biennial review of waste stream characterizations.

(8) Concurs in Technical Work Documents (TWDs) that may generate mixed waste.

1.4.4 Safety and Health Division, Code 106.2

(a) Provides guidance on personal protection requirements to personnel performing waste sampling and analysis.

(b) Provides or obtains MSDS's as requested by waste originators or personnel performing waste characterizations.

1.4.5 Environmental Division, Code 106.3

(a) Maintains technical liaison with Code 105.2 on dangerous waste regulations and hazardous waste management.

(b) Provides input to ensure that mixed waste analysis is consistent with hazardous waste analysis.

1.4.6 Laboratory Division, Code 134

(a) Prepares testing procedures and performs analysis as requested by Code 105.2.

(b) Maintains current technical information and documentation of analysis, including applicable EPA and Ecology methods.

(c) Concurs in procedures and sampling plans that deviate from sampling and analysis requirements.

(d) Maintain Washington State Laboratory Accreditation for environmental sample analysis.

1.4.7 Nuclear Engineering and Planning Department, Code 2300

(a) Provides technical assistance to Code 105.2 for waste analysis, as requested, including design specifications, drawings, procedures, and other process information.

(b) Identifies in TWDs where mixed waste may be generated. Provides sampling plans in Code 2300 TWDs where sampling is required. Specifies disposition of the waste in the TWD.

1.4.8 Waste Originator

(a) Ensures that the Radioactive Waste Information Sheet (RWIS) is filled out completely and accurately at the point of waste generation. The Radioactive Material Tag (RAMT) may be used to replace the RWIS when authorized.

(b) Provides updated information on the origin or process that generates the waste to Code 105.2.

2. Facility Description

Puget Sound Naval Shipyard generates a small amount of mixed waste as a result of radiological work on nuclear powered vessels. Additionally, PSNS accepts small amounts of mixed waste from off-station facilities that generate NNPP waste. Solid mixed waste streams are stored in a mixed waste storage facility (MWSF), Building 1002. Liquid mixed waste streams are treated to render them non-hazardous and disposed as low level radioactive waste (LLRW).

2.1 Waste Stream Identification and Designation

The majority of mixed waste managed at PSNS is generated on-site. Occasionally PSNS accepts NNPP mixed waste generated at off-station facilities. Each mixed waste item is characterized and designated using the techniques described in this document.

2.2 Dangerous Waste Management Units (DWMU's)

(a) Building 1002: The MWSF, Building 1002, was designed and constructed specifically to provide secondary containment for mixed waste generated by NNPP activities. In addition, the facility accepts small amounts of mixed waste from off-site facilities that generate NNPP waste.

Building 1002 is the storage location for the mixed waste generated or received at PSNS. The mixed waste stored inside the MWSF is contained in either metal drums or metal waste boxes. All stored waste streams are compatible. The facility is operated in accordance with the NNPP requirements, Washington State's Dangerous Waste Regulations, and the Toxic Substance Control Act requirements for the storage of radioactive, hazardous, and PCB waste, respectively.

(b) Building 983: Building 983 contains a 90-day accumulation area for mixed waste and is the Controlled Industrial Facility (CIF) where treatment by generator (TBG) is performed at PSNS. The CIF is also used for on-site processing of waste such as decontamination, segregation, packaging, and reclamation. Refer to reference (11) for more information about the mixed waste streams treated by PSNS.

3. Waste Analysis

A critical aspect of mixed waste compliance is performing an accurate and in-depth waste analysis. Waste analysis involves an initial characterization of the waste, followed by waste designation. Information gathered during waste analysis is key to ensuring proper handling, storage, transportation, treatment, and disposal. Accurate waste analysis also ensures the Shipyard maintains compliance with all applicable RCRA, TSCA, and Ecology regulations, and permit restrictions for the management of mixed waste. This section provides the waste analysis guidelines and requirements for characterizing and designating mixed waste. General instructions on how to characterize and designate mixed waste are provided in Sections 5 and 6 of this plan.

3.1 Waste Analysis Requirements

The following are the regulatory requirements for waste analysis. As regulations may change, the current regulatory requirements will take precedence if there is a conflict between this document and the regulations. Code 105.2 will use the referenced documents listed to ensure compliance.

(a) Waste requires evaluation to determine if the waste is mixed waste and/or a dangerous waste. Ecology has authority for establishing regulations to follow in the designation of waste. Ecology has incorporated these regulations into reference (1). Use reference (1) to designate waste.

(b) Waste may require evaluation to determine if it is PCB waste. The EPA has defined and established these regulations in reference (3). Use reference (3) for determining PCB waste. PCB waste can be dangerous waste and as such, regulated by reference (1).

(c) Evaluate waste determined to be a mixed waste for LDRs as part of the disposal process. The LDRs of reference (2) are incorporated into reference (1). As a result, use both references (1) and (2) for LDR determination.

(d) Dispose of wastes determined to be non-hazardous as low level radioactive waste (LLRW).

(e) The waste analysis process supports proper packaging of the waste for storage and transportation. Use reference (6) to determine transportation requirements.

(f) Use reference (7) to determine compatibility.

3.2 Documentation

Documentation of the waste characterization is an important part of the characterization process. Code 105.2 will retain sufficient documentation to demonstrate regulatory requirements have been followed. Each mixed waste package will have a mixed waste profile portfolio (MWPP), as required and defined by reference (4). The MWPP must clearly demonstrate the methodology used to characterize the waste and include enough detail to allow re-creation of the characterization by an independent party. The MWPP will demonstrate how and why process knowledge was used, sources of process knowledge, and any analytical testing performed. Reference (4) lists documentation required to be included in the MWPP.

3.3 Periodic Reanalysis of Waste Streams

Code 105.2 will perform waste reanalysis to ensure that changes to a waste stream are identified and all current regulatory requirements are met. All mixed waste streams will be reanalyzed according to the following cases.

3.3.1 Process Changes: The waste analysis will be repeated when the process that generates a waste changes. Code 105.2 will complete and document the reanalysis in a timely manner after

the waste originators make notification of a process change or there is reason to believe the process or operation generating the mixed waste has changed.

3.3.2 Discrepancies with Waste Shipped Off-site: The waste will be reanalyzed in accordance with this instruction upon notification by an off-site treatment, storage, and disposal (TSD) facility that waste received from PSNS does not match an approved waste stream, preapproved waste analysis certification, and/or the accompanying waste manifest or shipping papers.

3.3.3 Reanalysis of Existing Waste Streams: There are no specified regulatory time interval requirements for waste stream reanalysis. However, to ensure a waste stream is being properly managed and designated, periodic reanalysis will be conducted per this instruction and the following:

(a) Code 105.2 will perform a biennial review of all mixed waste streams generated at least once per year. Code 105.2 will update the characterization and designation of the waste stream if the review finds changes to the waste stream process, characteristics, or regulations since the last analysis. Sampling and testing will be performed biennially for those waste streams that use laboratory analysis.

(b) All common waste streams generated at least once a year and all uncommon wastes will be analyzed on a case by case basis.

(c) Code 105.2 will review waste analyses when regulations governing the waste stream or compliance laboratory procedures change.

3.3.4 Waste Received from Off-station: The waste received from off-station originates at other Naval facilities. The Shipyard concurs in the analysis of the waste prior to shipment. Off-station waste does not need to be sampled and tested upon receipt at the Shipyard due to acceptable knowledge of the waste.

4. Waste Parameter Selection and Rationale

Waste analysis parameters must be selected for each waste in order to perform adequate waste characterization; obtain sufficient data to ensure compliance with applicable regulatory requirements; conform to permit conditions; and ensure effective waste management operations. Select the waste analysis parameters to use for waste characterization based upon the amount of process knowledge available for the waste. Use several parameters for wastes with little or no documented process knowledge to analyze for unexpected constituents and ensure compatibility.

4.1 Parameters and Rationale

When characterizing NNPP mixed waste consider the parameters discussed in the following paragraphs and summarized in Table 1.

4.1.1 pH: Evaluate the pH of the mixed waste if the process that generated the waste indicates corrosive substances were used or if the process could have created a waste that exhibits a corrosive characteristic. Checking the pH ensures safe handling, storage, and treatment.

4.1.2 Flashpoint: Analyze waste suspected of being ignitable for its flashpoint. Analyses of wastes for ignitability using the flashpoint test method given in Table 1 is necessary to identify wastes that may be characteristically hazardous or that violate permit conditions.

4.1.3 Volatile Organic Compounds/Semi-volatile Organic Compounds: Analyze wastes for the presence of volatile organic compounds (VOCs) or semi-volatile organic compounds. The concentration of VOCs and semi-VOCs can be used to identify wastes that may violate permit conditions for storage and those wastes that would require special handling, treatment, or storage conditions. These parameters also affect the determination of applicable LDRs and treatment standards.

4.1.4 RCRA Toxic Metals (Lead, Cadmium, Chromium, Barium, Selenium, Arsenic, Silver, Mercury, Copper Oxide): The Shipyard identifies wastes that are regulated due to their RCRA toxicity by determining what metals and metal alloys are present in the waste. The information is used to identify applicable LDRs and treatment standards. Typically any debris, particulate matter, or waste that is known to contain metals or metal compounds will be evaluated for the presence of hazardous metals. The specific constituents analyzed in a given waste will depend on the type of waste and the amount of process knowledge known. For example, the Shipyard will include at a minimum lead, chromium, cadmium, and barium in the characterization of paint waste.

4.1.5 State Toxicity Criteria: The state of Washington has toxicity criteria in addition to the RCRA toxicity characteristics. Process knowledge and the waste analysis for metals and metal compounds provide the data necessary to determine the Washington state toxicity of the waste. The analysis of waste for the Washington state toxicity criteria is usually performed using the book designation method described in reference (1). The state toxicity determination ensures compliance with state regulations and permit conditions and allows identification of state-only LDRs.

4.1.6 Other Toxicity Characteristic Constituents: Constituents that exhibit RCRA toxicity characteristics include 1,1,1 trichloroethane, methyl ethyl ketone, and methylene chloride. When process knowledge or testing indicates a waste may contain a toxic constituent the waste analysis will include a determination of the presence and amounts of the applicable constituents. This information is used to determine LDRs and applicable treatment standards.

4.1.7 Radioactivity: Evaluate all mixed waste for radioactivity to determine applicable radiological controls in accordance with NNPP requirements.

4.1.8 PCBs: PCBs are considered a halogenated organic compound. PCBs are regulated by TSCA and can be regulated as dangerous waste per reference (1) under certain circumstances. Some

PCB waste is excluded from the requirements of reference (1), section 71. Testing the waste for PCBs ensures proper handling, treatment, and storage of the waste and allows the Shipyard to determine the applicable LDRs.

4.1.9 Persistent Constituents: Persistent compounds are either halogenated organic compounds (HOCs) or polycyclic aromatic compounds (PAHs). The persistent compounds found in NNPP mixed waste include 1,1,1 trichloroethylene and PCBs. Combine the results of EPA SW-8260, SW-8270, and SW-8082, if PCBs are not excluded by reference (1), to obtain the persistence value. The persistent constituent determination helps the Shipyard comply with permit conditions and properly handle, store, and treat the waste.

4.1.10 Asbestos: Evaluate mixed waste for asbestos when the waste is suspected of containing asbestos, such as lagging. Asbestos is not normally regulated as a hazardous waste. The Shipyard may need to consider alternate treatment options if the waste contains asbestos.

4.1.11 Compatibility: Evaluate any new waste or one of unknown chemical composition for compatibility with the other mixed waste in storage. Reference (7) provides guidance on determining the compatibility of dangerous waste. This evaluation ensures safe handling, storage, and treatment of the waste.

4.1.12 Listed Constituents: Puget Sound Naval Shipyard does not authorize the use of chemicals that create F-listed waste. Some F-listed wastes are stored in the MWSF. The F-listed constituents stored in the MWSF are:

(a) F002: 1,1,1 trichloroethane and methylene chloride
(b) F003: acetone, methanol, ethyl benzene
(c) F005: methyl ethyl ketone (MEK).

4.1.13 Reactive Constituents: The mixed wastes currently generated and stored at PSNS are known to be non-reactive. If process knowledge of a waste that has an unknown chemical composition or unknown characteristics indicates the waste may be reactive Code 105.2 will work with the Laboratory to develop a sampling and analysis plan for that specific waste. The analysis plan will evaluate the waste for cyanide and sulfide using methods outlined in EPA SW 846, reference (8). The plan will ensure safe handling, storage, and treatment of the waste, ensure compliance with permit conditions, and provide information for determining the LDRs.

TABLE 1 MIXED WASTE ANALYSIS PARAMETERS AND RATIONALE			
Parameter	**Physical State**	**Test Method[a]**	**Rationale**
pH	solid, semisolid	9045	Ensure safe handling, treatment, and storage of the waste; determine applicability of LDRs and state-only requirements.
	liquid	9040, 9041	
Flashpoint	liquid	ASTM Standard D-3278-78[b]	Comply with permit conditions; determine applicability of LDRs.
	solid	Meets requirements of WAC 173-303-090(5)(a)(ii)	
Volatile organic compounds	solid, water, organic liquids	8260	Comply with permit conditions; determine need for special handling, treatment, or storage; determine applicability of LDRs.
Semi-volatile organic compounds	solid, water, organic liquid	8270	Comply with permit conditions; determine need for special handling, treatment, or storage; determine applicability of LDRs.
PCBs	solid, water, organic liquid	8082	Ensure proper handling, treatment, and storage; determine applicability of LDRs.
Lead Cadmium Chromium Barium Selenium Arsenic Silver Mercury Cuprous oxide	solid, semisolid, liquid	3051, 1311, 6010, 7470, 7760	Identify applicable LDRs; ensure compliance with permit restrictions and treatment standards.
Persistent constituents	solid, water, organic liquid	8260, 8270, 8082	Comply with permit conditions; determine need for special handling, treatment, or storage; determine applicability of LDRs.
Asbestos	solid	Polarized light microscope[c]	Ensure proper handling, storage, and disposal.
Radioactivity	solid, liquid, semisolid	NNPP test methods	Ensure proper handling, storage, and disposal; determine applicability of LDRs.

a. All test methods are found in "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", EPA Publication SW-846, unless otherwise noted.
b. American Society for Testing Materials (ASTM).
c. 40 CFR Part 763 Subpart E App E.

5. Waste Characterization Methodology

The Shipyard uses two basic methods, process knowledge and laboratory analysis, to obtain sufficient information to ensure mixed waste is properly characterized. PSNS evaluates the mixed waste for properties such as chemical composition, ignitability, corrosivity, reactivity, toxic characteristics, waste source, physical properties, and compatibility with other wastes and process equipment. The Shipyard follows the guidelines given in section 5.3 of this instruction to perform mixed waste characterization in accordance with reference (1).

5.1 Process knowledge

Process knowledge is the preferred method for mixed waste analysis due to the radioactive nature of mixed waste. Use of process knowledge, whenever sufficient knowledge exists, minimizes personnel exposure to radiation and contamination. Use process knowledge when there is sufficient information on the waste item to clearly identify the presence or absence of all applicable constituents or characteristics causing the waste to be regulated under reference (1). Document all process knowledge used in characterizing a waste in the mixed waste profile portfolio (MWPP) for final designation and determination of LDRs. Process knowledge used during waste characterization may include, but is not limited to:

5.1.1 Drawings: Use drawings and contained references to identify components of a mixed waste that may contain a constituents that cause the waste to be regulated under reference (1). Obtain drawings from the manufacturer and from the Naval or Contract Engineers who designed the item under evaluation.

5.1.2 Technical Work Documents (TWDs): Use information from the TWDs associated with the mixed waste to determine any constituents that cause the waste to be regulated under reference (1) introduced during work, identify any drawings related to the waste, and identify any technical information related to the manufacture or use of the item. TWDs include instructions for the manufacturing and assembly process, operational instructions, and procedures removing the item or creating the waste.

5.1.3 Vendor Information: Use vendor information about the chemical content of the mixed waste when available to identify any constituents that cause the waste to be regulated under reference (1), and concentrations of such constituents. Vendor information may include technical manuals, Material Safety Data Sheets, chemical specifications, and product label information.

5.1.4 Government Specifications: Use military and federal specifications, if available, to identify constituents that cause the waste to be regulated under reference (1). Vendors providing the material are required to meet these specifications and can detail the chemical constituents. Government contracts also may include specifications.

5.1.5 Originating Process: Obtain knowledge of the process that created the mixed waste or how the mixed waste was used from information provided by the generator and from applicable work documents that were used to generate the waste.

5.1.6 Prior Characterizations: Obtain analyses and data from previously characterized mixed waste of similar waste types.

5.1.7 Physical Observation of the Waste: Observing the waste in conjunction with other process knowledge may assist in the waste characterization process.

5.2 Laboratory Analysis

Use laboratory analysis when there is not enough information on the waste item to clearly identify the presence of all constituents that cause the waste to be regulated under reference (1) or characteristics that may cause such waste to be regulated under reference (1). Laboratory analysis performed to facilitate waste characterization includes:

5.2.1 Screening Sampling and Analysis: When appropriate use NNPP screening sampling and analysis methods to verify the presence of expected chemical constituents in the mixed waste. Select the test methods based on process knowledge. NNPP screening sampling and analysis methods may differ slightly from methods generally approved by Ecology in order to minimize personnel exposure to radioactivity while providing adequate information about the waste. For example, PSNS collects TCLP samples for screening in plastic containers rather than the glass containers required by Ecology. The plastic containers help protect sampling and analysis personnel from radioactive contamination by minimizing the risk of a mixed waste spill caused by a broken glass sample container.

5.2.2 Compliance Sampling and Analysis: Compliance sampling and analysis is required if the necessary properties cannot be determined from process knowledge. Conduct compliance sampling and analysis in accordance with this instruction relative to parameter selection, analytical procedure selection, sampling procedures, and laboratory selection. Appendix A and Appendix B contain requirements on compliance sampling and testing, respectively. Radioactive samples should only be obtained if process knowledge or non-radioactive/surrogate samples are not sufficient or are impractical.

5.2.3 Surrogate Analysis: Surrogate analysis is the process of analyzing a chemically identical, non-radioactive waste to characterize a mixed waste. There are two common approaches to using surrogate analysis: sample and test wastes from a chemically identical, non-radioactive waste stream or process, or create a non-radioactive mock-up of the waste using knowledge of the process and test the result. Adhere to all compliance sampling and testing protocols when testing a surrogate material. Maintain the same degree of documentation as required by the compliance sampling and testing protocols. Perform surrogate analysis to written procedures.

5.3 Characterization Methodology

The complete process for characterizing each individual mixed waste produced at PSNS cannot be detailed in this instruction due to the wide variability of wastes and circumstances. This section contains general requirements and guidelines for performing mixed waste characterization in accordance with reference (1).

5.3.1 Treatment by Generator Wastes: The waste analyses of mixed waste streams that are rendered non-hazardous by treatment within the Shipyard are presented in the Treatment by Generator Waste Analysis Plan, reference (11).

5.3.2 General Procedure for Mixed Waste Evaluation: Code 105.2 is responsible for evaluating and characterizing mixed waste at PSNS. The general procedure for mixed waste characterization is discussed in the following paragraphs.

(a) Evaluate the RWIS and any other information provided by the mixed waste generator. Ensure the RWIS is complete. Contact the generator in a timely manner if any information is missing or questionable. The RAMT may be used when authorized.

(b) Collect and record all process knowledge that could provide credible data on the source, process, composition, or other knowledge. The data could include the TWD, a drawing, MSDS, or any other useful information. Use the information provided in the process log if provided.

(c) Information from a previous characterization may be used if the waste is the same as or similar to a previously characterized waste. Provide documentation that verifies the wastes are similar.

(d) Choose the parameters for which the waste will be analyzed based on the process knowledge. Section 4 of this instruction provides a description of each of the parameters. Choose as many of the parameters as necessary to obtain a detailed analysis of the waste.

(e) Use the experience of other personnel. Code 105.2 personnel can provide guidance in determining what parameters and methods are needed for analysis of the mixed waste.

(f) Determine if the process knowledge available is sufficient to accurately characterize the waste. If the process knowledge is insufficient, sampling and testing are required. Sampling and testing may also be necessary to verify the presence of expected waste constituents or to demonstrate regulatory compliance. Prepare a sampling methodology and instruction, if not already available, in accordance with Appendix A of the MWAP to facilitate sampling of the mixed waste. Determine what parameters and test methods must be used to assemble a complete profile of the waste's compatibility, corrosivity, reactivity, toxicity, and ignitability.

(g) Once all process knowledge and/or analytical results have been collected, prepare the mixed waste profile record (MWPR) and MWPP in accordance with reference (4). The MWPR provides the historical documentation of the waste analysis and must be as complete as possible. Maintain a copy of the documents used to demonstrate process knowledge in the MWPP if no other administrative instruction requires the documents be retained for a longer period of time. Refer to reference (4) for guidance on document retention.

(h) Prepare a written summary of the characterization process. The summary should be a description of the parameters used to characterize the mixed waste; how and why the parameters were chosen; references used for the characterization; and justification for any assumptions made. The summary should be detailed enough to allow the characterization to be re-created at a later date. Sign and date the summary.

5.4 Additional Guidance

Use the following additional guidance when documenting the mixed waste characterization.

5.4.1 References (internally generated shipyard documentation) should clearly identify the constituent material by chemical composition or unique generic material description, such as polyethylene plastic, Buna-N rubber, or cuprous oxide. Minimize the use of acronyms and product nicknames not commonly known.

5.4.2 Do not use the waste package/container weight and volume in the weight averaging calculations. Include materials added to the waste for the purpose of liquid absorption or padding, such as paper absorbent and tape, in the characterization of the waste.

5.4.3 Ensure any prior characterizations referenced contain adequate documentation to support the current analysis.

5.4.4 Toxicity characteristics: Weight averaging is acceptable when evaluating a complex component that cannot be easily separated into individual components. For instance, to determine whether a complex component would contain sufficient toxic metals to fail the TCLP test consider the entire component as a whole rather than each piece of the component. Paint coatings and plating that contain lead, chromium, or cadmium are not a separate part of a component. Paint coatings and plating are inclusive to the component to which the paint or plating is adherent. Consider the paint or plating as part of the component.

(a) Use either of the following methods to determine the toxicity of suspected toxic wastes for which TCLP results are not available:

- compare the total weight percent of each TCLP regulated constituent to the TCLP maximum weight percent as given in Table 3, or
- compare the concentration of the each TCLP regulated constituent in the waste to 20 times the TCLP regulatory level (ppm) as given in Table 3.

Use a conservative estimate if laboratory data or literature is limited. For example, use the highest chromium concentration given in the available literature or test data for a type of paint of unknown chromium concentration.

(b) Use TCLP leachability proportioning to demonstrate a waste characterization when the total weight percent or concentration of the TCLP regulated constituent is nearly equal to the regulatory limit. The method applies the proportion of the expected TCLP leachability of the individual parts of a complex component to the entire component. Figure 2 provides an example of TCLP leachability proportioning for brass and bronze at specific lead concentrations.

For example: Consider a complex component that consists of two materials. One component part leaches Cadmium at 5.0 ppm in a TCLP test. This part constitutes 10 percent of the complex component. No other Cadmium is present. The proportioned TCLP leachability of the entire complex component is:

[5.0 ppm Cadmium x 10%] + [0.0 ppm Cadmium x 90%] = 0.5 ppm Cadmium.

Therefore, the complex component in this example does not exceed the limit of 1.0 ppm.

(c) For materials estimated to contain TCLP regulated constituents in quantities approaching the TCLP limits justify the estimated values in the MWPP. Include a similar justification in the MWPP if the estimated TCLP values are used in the waste designation. Include any supporting documentation for the estimated TCLP.

(d) Table 2 and Figure 2 provide leachability data from some common metals and alloys encountered in radioactive work.

5.4.5 Brass and bronze: Many items made of brass or bronze contain lead in sufficient quantities to require the items be regulated as hazardous waste. Use the following guidance when evaluating brass and bronze.

(a) Brass and bronze that are known to contain less than or equal to 1% lead are not regulated as hazardous wastes.

(b) Brass or bronze forging, such as fasteners, pipes, tubing, and electrical parts, typically contain small percentages of lead to allow for easier machining. Assume brass or bronze forging contains 3% lead unless the lead content is known.

(c) Assume brass or bronze casting, such as valves, pipe fittings, elbows, and flanges, contains 8% lead unless the lead content is known.

(d) Assume bearing and bushing materials made of brass or bronze contain 15% lead unless the lead content is known.

(e) TCLP proportioning per paragraph 5.4.4(b) may be performed using the above conservative percentages. Figure 1 provides guidance on proportioning items containing brass or bronze components.

(f) Figure 2 shows the relationship between total lead content and TCLP leachability of brass and bronze based on Shipyard testing of lead alloys. The graph may be used to determine leachability factors for leachability averaging of non-homogeneous waste containing brass or bronze components in accordance with paragraph 5.4.4.(c).

5.4.6 Perform PCB evaluations using the guidance in section 4.1.7 and Table 1.

5.4.7 Reference (7) provides guidance for evaluating the compatibility of a waste.

TABLE 2

TCLP TEST RESULTS FOR LEACHABILITY FACTORS

METAL/ALLOY	MATERIAL COMPOSITION	TCLP TEST RESULT (ppm)	TCLP LIMIT (ppm)	ASSESSMENT
Silver-Braze Alloy	Ag 34%	Ag < 1.0	Ag 5.0	Pass
	Cd 17%	Cd 2.7	Cd 1.0	Fail
Cadmium Plating	Cd (Chromated)	Cd 362	Cd 1.0	Fail
		Cr 0.2	Cr 5.0	Pass
Leaded Brass/Bronze	Pb 22.2%	Pb 251	Pb 5.0	Fail
	Pb 1.4%	Pb 25.5	Pb 5.0	Fail
	Pb 1.02%	Pb 2.6	Pb 5.0	Pass
Chromium Plating	Cr 100%	Cr 0.8	Cr 5.0	Pass
Zinc galvanize (electrodeposited)	Zn (Chromated)	Cr 0.3	Cr 5.0	Pass
Zinc galvanize (Hot dipped)	Zn with lead	Pb < 0.1	Pb 5.0	Pass
Silver Plating	Ag 100%	Ag 2.4	Ag 5.0	Pass
Zinc Anode	Zn with trace Cd and Pb	Cd 0.46	Cd 1.0	Pass
		Pb 0.003	Pb 5.0	Pass
Leaded Steel	Pb 0.2%	Pb < 0.1	Pb 5.0	Pass
430 Stainless Steel	Cr 16.5%	Cr 0.3	Cr 5.0	Pass
410 Stainless Steel	Cr 12.5%	Cr 2.2	Cr 5.0	Pass

TABLE 3

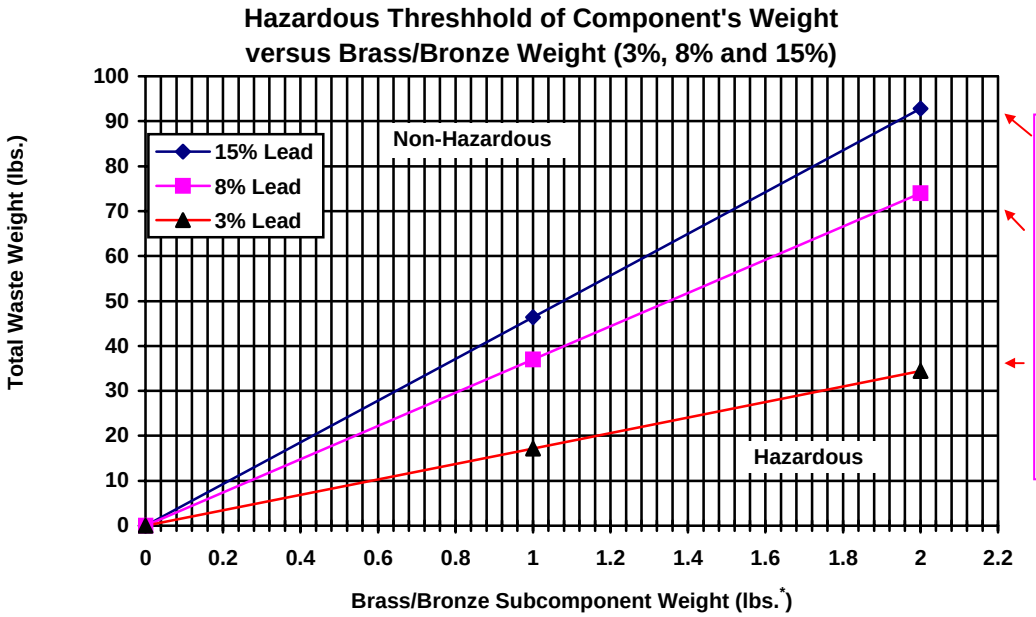
TCLP SPECIFICATIONS

	TCLP Regulatory Level (ppm)	Max Weight Percent in Solid
Metals		
Arsenic	5.0	0.01
Barium	100.0	0.2
Cadmium	1.0	0.002
Chromium	5.0	0.01
Lead	5.0	0.01
Mercury	0.2	0.0004
Selenium	1.0	0.002
Silver	5.0	0.01
Volatiles		
Benzene	0.5	0.001
Carbon Tetrachloride	0.5	0.001
Chlorobenzene	100.0	0.2
Chloroform	6.0	0.012
1,2 Dichloroethane	0.5	0.001
1,1 Dichloroethylene	0.7	0.0014
Methyl Ethyl Ketone	200.0	0.4
Tetrachloroethylene	0.7	0.0014
Trichloroethylene	0.5	0.001
Vinyl Chloride	0.2	0.0004

FIGURE 1

BRASS/BRONZE TCLP PROPORTIONING GRAPH

Instructions: plot the total component weight versus the weight of the brass/bronze sub-component. If the point is above the applicable 3%, 8%, or 15% line, the component is non-hazardous for leaded brass/bronze. If it lies on or under the applicable line, the component is hazardous.



15% Leaded Brass/Bronze: bearing and bushing materials.

8% Leaded Brass/Bronze: brass or bronze casting such as valves, pipe fittings, flanges and elbows.

3% Leaded Brass/Bronze: brass or bronze forging such as fasteners, tubing, pipe and electrical parts.

* Note that the 'X' axis can be read as 0 to 2 Lbs., 0 to 0.2 Lbs., 0 to 20 Lbs. or 0 to 200 Lbs. Once a curve is selected the relationship between waste weight and bronze weight is linear. The 'Y' axis must be adjusted by the same multiplier as the 'X' axis when a different scale is used.

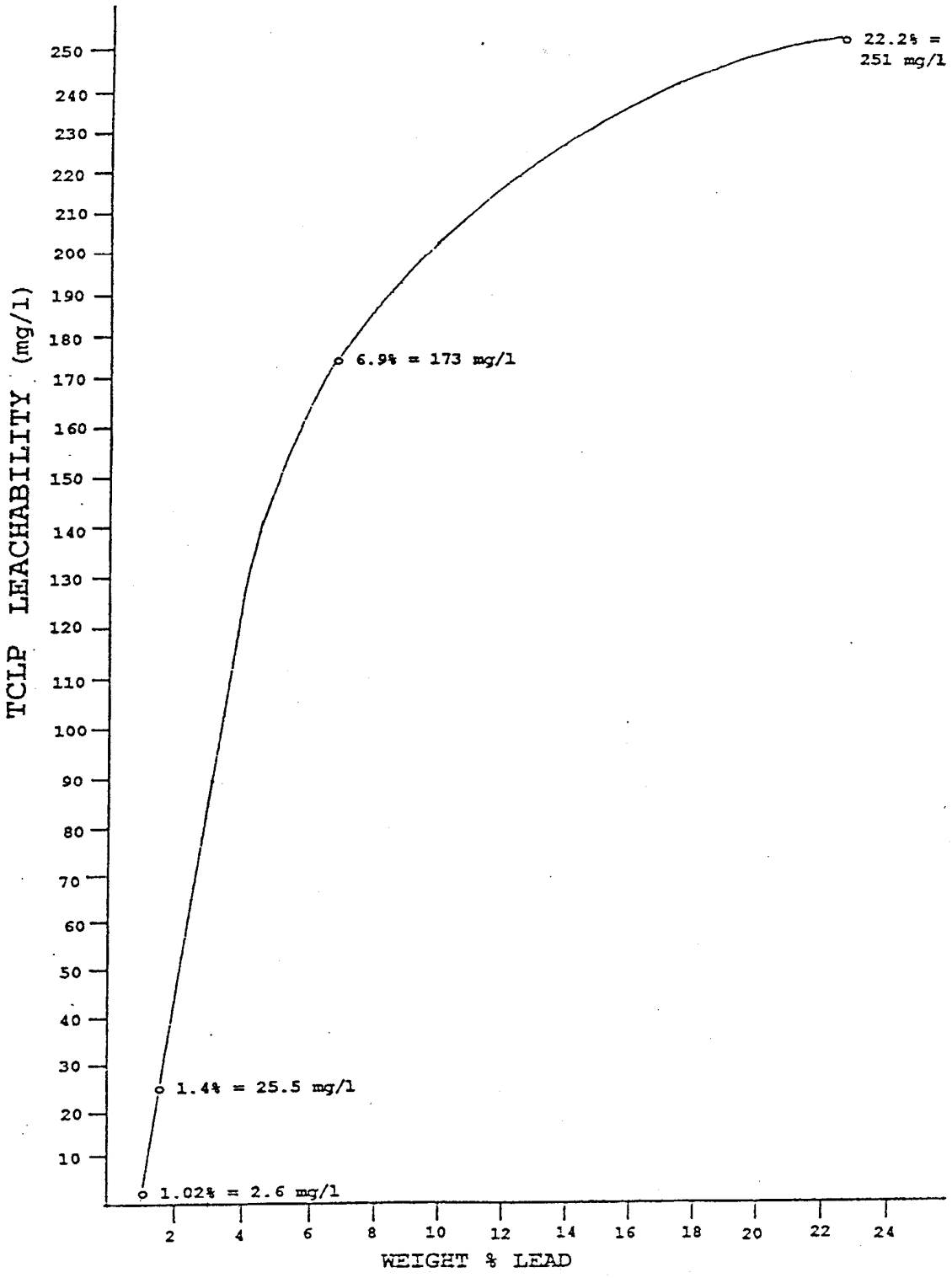


Figure 2
LEAD LEACHABILITY FROM BRASS/BRONZE

6. Waste Designation

After the characterization is complete, Code 105.2 will review the MWPP and designate the waste. Code 105.2 will review the MWPP for completeness and accuracy and note any questions or errors. Following any necessary revision of the MWPP Code 105.2 will designate the waste in accordance with section 70 of reference (1) and complete and sign the applicable portions of the MWPR.

6.1 Designation

The basic designation process is summarized in the following paragraphs.

6.1.1 Determine if the waste is a discarded chemical product. [reference (1), section 081]

6.1.2 Determine if the waste is a listed dangerous waste source using reference (1), section 082.

6.1.3 Determine if the waste exhibits any dangerous waste characteristics. [reference (1), section 090]

6.1.4 Determine if the waste meets any of the dangerous waste criteria. [reference (1), section 100]

(a) Toxicity is determined by using the book designation procedure or bioassay tests. The Shipyard uses the book designation procedure, reference (1), section 100(5)(b), almost exclusively to evaluate mixed waste against the toxicity criteria.

(b) Persistence: The known persistent constituent concentrations are summed to determine the total HOC concentration and the total PAH concentration. The waste is then evaluated against the criteria listed in reference (1), section 100(6).

6.1.5 Determine if the waste is in an excluded category of waste [reference (1), section 071].

6.1.6 Determine if the waste is a dangerous waste, an extremely hazardous waste, or is considered non-hazardous radioactive waste. Assign the applicable dangerous waste numbers.

6.1.7 Determine if the waste needs to be controlled under TSCA.

6.2 Compatibility and LDR Determination

Use the designation to aid in determining the compatibility of the mixed waste to the other mixed wastes in storage and to identify any LDRs.

6.2.1 Determine the compatibility of the waste with the others stored in the MWSF. [reference (7)]

6.2.2 Determine what LDRs apply to the waste in accordance with references (1) and (2). Include a list of underlying constituents that cause the waste to be regulated under reference (1), if applicable.

6.3 Documenting Designations

Include a record of all dangerous waste numbers assigned, LDRs, and a summary of the parameters and characteristics used in the designation as part of the MWPP.

APPENDIX A

SAMPLING REQUIREMENTS

1. Sampling Strategies

When sampling is necessary the cognizant technical code will develop a written sample plan. Code 105.2 will provide assistance if requested. Chapter 9 of reference (8) provides guidance on sampling and sampling plans and is the basis for this appendix. Code 105.2 must concur on all sampling plans or procedures containing sampling plans. This concurrence may be provided by a designated branch head within Code 105.2.

1.1 Sampling Objectives

Prepare sampling plans to meet the following objectives.

1.1.1 Ensure the sample is representative of the waste being sampled.

1.1.2 Collect an uncontaminated sample.

1.1.3 Present the sample to the lab in a container that is compatible with the waste, will not result in sample degradation while awaiting analysis, and will allow the laboratory to perform the desired analysis.

1.1.4 Ensure the sample and sampling method can be traced back to the material being sampled.

1.1.5 Specify the size of the samples required.

1.1.6 Specify the chemical constituents for which the laboratory will analyze the sample. Sampling personnel use this information to complete the Sample Analysis Request (SAR) form. The SAR is sent to the laboratory with the sample.

1.2 Sample Types

The type of sample collected will be based on the parameters selected for analysis and the physical state of the waste. Specify the type of sample to be used in the sampling plan. Two basic types of samples can be taken as described in the following paragraphs.

1.2.1 The grab/discrete sample is an individual sample taken from a single location at a specific time. As a result, the analytical results represent the specific sample site. Several grab/discrete samples can be taken and statistically evaluated to determine how well the samples actually represent the material being sampled. Grab/discrete samples can also be used to characterize homogenous waste streams.

1.2.2 A composite sample involves obtaining multiple grab/discrete samples from the waste. The samples are mixed together and the mixture presented to the lab for analysis. This type of sample will give analytical results as an average constituent concentration.

1.3 Selection of Sampling Sites/Locations

1.3.1 Sampling would normally be conducted at the site of waste generation or at a 90-day accumulation area prior to transferring the waste to the MWSF. Certain unusual circumstances would require that the Shipyard transfer mixed waste from the MWSF to a Radiological Work Facility for additional characterization (chemical and/or radiological). This additional characterization would become necessary if the treatment facility targeted to take the waste changes or if the waste acceptance criteria of the treatment facility requires additional characterization.

1.3.2 In order to obtain a representative sample the cognizant technical code must specify the exact location on the waste item in which to take the sample.

1.4 Number of Samples

More than one sample may be required to properly evaluate a waste. The physical characteristics and variability of contaminants in the waste affect the number of samples needed. The cognizant technical code will specify the number of samples required or the methodology to use to determine the required number of samples. A sample plan may be very simple, such as obtaining a single grab/discrete sample from a drum, or very complicated, such as establishing grids and taking composite samples from each grid location. Additional guidance can be obtained from Chapter 9 of reference (8).

1.5 Sampling Frequency

Sample mixed waste when data is needed to assist in waste characterization or for a periodic re-analysis of waste streams. Refer to section 3.3 of the main body of this instruction for waste stream re-analysis guidance.

1.6 Sample Collection and Handling Techniques

The sampling plan must contain all sampling and handling techniques. If the sampler feels the plan is inadequate, the sampler must resolve the deficiencies with the author of the sampling plan prior to sampling. Sampling methods for special types of waste are specified in section 110 of reference (1). Ecology must approve an equivalent method if the sampling method will deviate from those specified in reference (1), section 110.

1.7 Physical Properties of the Waste

Consider the physical properties of the waste during the development of a sampling plan. Items that should be addressed are:

1.7.1 The homogeneity of the waste and

1.7.2 The physical state of the waste (gas, liquid, or solid). This property may prevent the sample specified from being obtained without further instructions. For example, TCLP samples of solid waste may need to be machined in order to meet the particle size requirements for analysis.

1.8 Chemical Properties of the Waste

The chemical properties of the waste may need to be addressed in developing a sampling plan. Consider the following:

1.8.1 A waste that has the characteristics of ignitability or reactivity may require special handling techniques to protect the sampling technicians and laboratory personnel.

1.8.2 Ensure the sampling technique specified will result in representative samples of the waste, not products of reaction of the waste with the air or sample equipment.

1.9 Special Circumstances or Considerations

Some waste may require special considerations for obtaining samples. Highly corrosive liquids, for example, may require unique handling procedures or sampling techniques. Special radiological conditions may warrant additional considerations.

1.10 Authoritative Sampling

Authoritative sampling is used when sufficient historical, site, or process knowledge is available to accurately assess the chemical and physical properties of a waste. This type of sampling involves the selection of sample locations based on knowledge of the waste distribution, waste properties, and waste management practices. The validity of the sampling depends upon the accuracy of the information used. The rationale for the selection of the sample locations is critical and must be well documented.

1.11 Random sampling

Use random sampling techniques when insufficient knowledge exists to perform authoritative sampling (see Table A-1).

TABLE A-1
RANDOM SAMPLING TECHNIQUES

Type	Description	Use	Advantages/Disadvantages
Random (simple, stratified, and systematic)	Techniques where sample selection and location are determined through the application of statistical methods.	Used to collect representative samples where data are insufficient to justify authoritative sampling.	See discussion below for each respective random sampling technique.
Simple Random	All location/points in a waste or unit from which a sample can be attained are identified, and a suitable number of samples are randomly selected.	Used to collect representative samples of waste that are heterogeneous	Advantage: Most appropriate where little or no information is available concerning the distribution of chemical contaminants. Disadvantage: May misrepresent waste streams with areas of high concentration of stratification.
Stratified Random	Areas of non-uniform properties or concentrations are identified and stratified. Subsequently, simple random samples are collected from each stratum of the waste.	Used to collect representative samples from waste or units that are known to have areas of non-uniform properties (strata) or concentrations (hot spots).	Advantages: Provides for increased accuracy of waste streams representation if strata or a typically high or low concentration area is present. Disadvantage: Requires greater knowledge of waste stream than for simple random sampling and may require sophisticated statistical applications.
Systematic Random	The first sampling point is randomly selected. All subsequent samples are collected at a specific distance from the previous sample.	An alternate procedure used to collect representative samples from heterogeneous waste streams; allows simplified sample identification.	Advantages: Easier sample identification and collection than other techniques. Disadvantages: May misrepresent waste streams with unknown areas of high concentration or stratification.

2. Selecting Sampling Equipment

2.1 Physical Parameters

The physical properties of the waste will affect the type of sampling equipment to use. Chapter 9 of reference (8) provides a description of various types of sample equipment. Common sampling devices used in the Shipyard include scoops, shovels, and suction pumps. Code 105.2 must approve the use of sampling devices not described in chapter 9 of reference (8). This approval may be provided by a designated branch head within Code 105.2.

2.2 Chemical Parameters

The equipment used in sampling must be compatible with the waste and not susceptible to reactions that might alter the physical and chemical characteristics of the waste.

2.3 Waste-specific or Site-specific Factors

Waste-specific or site-specific factors may also affect the use of sampling devices. Sludge and highly corrosive waste may alter the use of standard sampling equipment. If a waste is located in a container with limited access, standard sampling equipment may not be suitable or may need modification.

2.4 Equipment

The Shipyard uses disposable sample equipment if possible. If sample equipment will be reused, the sampling plan must provide instructions for maintenance and decontamination.

3. Sampling Preservation and Storage

3.1 Preservation

The sample will be delivered to the laboratory as soon as practicable after it is collected. If the sample cannot be delivered to the lab by the end of the shift during which it was collected, employ sample preservation techniques, if applicable, to ensure the integrity of the waste remains intact while the sample is transported to the laboratory and/or while temporarily stored. Table A-2 contains preservation requirements. The sampling plan will provide guidance on sample preservation requirements, methods, and storage for the time between sample collection and delivery to the laboratory. Code 134 will handle the samples within the laboratory facility in accordance with reference (5) instructions.

3.2 Refrigerating Samples

Transfer samples requiring refrigeration to the custody of the laboratory immediately after the samples are collected.

4. Quality Assurance and Quality Control Procedures

4.1 Quality Assurance (QA) is accomplished by the following.

4.1.1 Sampling plans and procedures containing a sampling plan are prepared by the cognizant technical code with concurrence from Code 105.2.

4.1.2 The chain of custody protocol is used for all samples (see section 4.3 of this appendix).

4.1.3 The Shipyard participates in the internal mixed waste self-assessment program, as required by reference (4).

4.2 Quality Control (QC) is established by reference (5) and additional requirements specified in the sampling plan. Sampling plans will periodically specify one of the following types of QC methods to be used in the field.

4.2.1 Field duplicates are independent samples that are taken from the same location at the same time and are used to measure the effectiveness of obtaining representative samples. The precision of the field duplicates provides a reflection of the variance inherent in the waste composition and the sample technique. Field duplicates should be collected from a homogenized sample (solid/sludge) or as consecutively collected samples (liquid). Field duplicate samples should be collected at a frequency of 10 percent for solids/sludge and liquid samples.

4.2.2 Trip blanks are sample containers prepared with an inert material, such as deionized water, and carried into and out of the field but are not opened at any time during the sampling event. If the trip blank is contaminated, the source of the contamination is assumed to be the container itself, the environment in which the trip blank was prepared, or some other source located outside the sample area. Trip blanks are provided by the laboratory personnel and should be used for each sampling event that includes volatile organic compound analysis.

4.2.3 Equipment blanks are prepared prior to sampling by running deionized water over sampling equipment and collecting the water into a clean sample container. If the equipment blank is contaminated, the source of contamination is assumed to be equipment used during the sampling operations. An equipment blank or field blank should be collected at a frequency of 10 percent of sampling events.

4.2.4 Field blanks are prepared in the field by filling a clean container with deionized water and appropriate preservatives, if any, for the specific sampling activity. Field blanks are collected between sampling locations or after sampling is completed, following decontamination of sampling equipment, where applicable. If contaminants are found in the field blank, it is assumed that environmental factors, such as airborne contamination; sampling procedures, causing cross contamination; or contaminated equipment were contributing to the concentration of hazardous waste constituents found in the sample. An equipment blank or field blank should be collected one time out of every 10 sampling events.

4.2.5 Split samples are typically collected for enforcement purposes and as a check on the Shipyard's analytical program and data record keeping. The sample is collected, and the sample volume is divided into halves. Each half is dispensed it into a different container.

4.3 Chain of Custody

The SAR and proper logging, labeling, and handling assure the chain of custody for samples. Sampling personnel fill out the SAR and maintain the sample log. Reference (4) specifies labeling and sample logbook requirements. Reference (9) describes the SAR and how it is used. Follow reference (5) once the Shipyard Laboratory receives the samples.

5. Health and Safety Protocols

The Shipyard has programs in effect to ensure the safety of personnel handling mixed waste. At a minimum, all mixed waste will be handled in accordance with the proper Personnel Protective Equipment (PPE) for the radioactive content of the waste. The cognizant technical code must use process knowledge to determine the need for additional PPE for sampling and analysis and will specify in the required PPE in the sampling plan. Code 105.2, with assistance from Code 106.2, will establish the PPE requirements for a mixed waste with little or no known characteristics.

6. Sampling Plans

Sampling plans may be included in an existing TWD that generates or handles the waste, in a separate TWD, or in a standing instruction. The sampling plan will specify or refer to a procedure that contains the following elements:

(a) Description of the waste to be sampled.

(b) Parameter(s) for which to sample and analyze.

(c) Sampling location, if the sampling location will affect the sampling.

(d) Sample size and number of samples.

(e) Sample container type.

(f) Sampling technique and equipment.

(g) Decontamination of sampling equipment, if it will be re-used.

(h) Additional training, if required.

(i) Preservation requirements, if applicable.

(j) Any special instructions necessary to ensure a representative sample is obtained.

(k) Sample type (composite or grab/discrete).

(l) Special health and safety protocols associated with the sampling.

(m) Applicable quality control instructions or methods for use in the field.

TABLE A-2
SAMPLE PRESERVATION METHODS

Parameter to Test	Waste Matrix	Sample Size	Container Material	Preservation Requirements	Max. Hold Time
Volatile Organic Compounds	Water and Organic Liquids	Two 40 ml	Glass with PTFE Lined Cap	Cool to 4° C, $NaHSO_4$ to pH<2 No Airspace	7 Days
	Solid	40 mL vials or 125 mL wide mouth	Glass with PTFE Lined Cap	Cool to 4° C	14 Days
Semi-Volatile Organic Compounds	Water	1000 ml	Glass with PTFE Lined Cap	Cool to 4° C,	7 Days
	Solid	250 mL wide mouth			Extract samples within 14 days; analyze extracts within 40 days following extraction
	Organic Liquids	40 ml			14 Days
pH	Solid/ Semisolid	5 g	Plastic or Glass	None	None
	Liquids	40 ml		None	2 Hours
PCBs	Water	1000 ml	Glass with PTFE Lined Cap	None	None
	Solids	10 g			
	Oils	40 ml			
Flashpoint	Liquids	40-50 ml	Glass	None	None
RCRA Toxic Metals (TCLP) *Mercury* *Lead* *Cadmium* *Chromium* *Barium* *Selenium* *Arsenic* *Silver*	Solid/ Semisolid	110 g	Plastic or Glass	None	6 Months (28 Days for Mercury)
RCRA Toxic Metals (Total Metals) *Mercury* *Lead* *Cadmium* *Chromium* *Barium* *Selenium* *Arsenic* *Silver*	Solid/ Semisolid	5 g	Plastic or Glass (except Mercury) Glass (Mercury)	None	24 Hours (Chromium VI) 28 Days (Mercury) 6 Months (all others)
	Liquids	500 ml (Cr VI and Hg)		HNO_2 to pH<2 (except Cr VI-cool to 4° C)	

Notes: Preservation requirements only apply if the sample cannot be delivered to the lab by the end of the shift.

APPENDIX B

LABORATORY TESTING AND ANALYTICAL METHODS

1. Selecting a Laboratory

The Shipyard Laboratory is the primary facility used for all compliance analysis of waste and is accredited by the State of Washington. Off-site facilities may be used if the Shipyard Laboratory's work load is very high or the Shipyard Laboratory cannot perform a particular analytical procedure, such as biological testing as specified in *Biological Testing Methods DOE 80-12 Revised June 1992*. A contractual agreement between the Shipyard and the off-site laboratory is required to perform off-site waste analysis. The cognizant technical code will coordinate with Code 134 and Code 105.2 to choose the laboratory and award the contract. Refer to reference (10) for guidance on selecting an off-site laboratory. Provide Code 105.2 a copy of all analytical reports on any mixed waste analyzed by an off-site laboratory.

2. Comprehensive QA/QC Program (both qualitative and quantitative)

The Shipyard Laboratory has a comprehensive QA/QC program, addressing both the qualitative and quantitative aspects of laboratory operations (see reference (5)). Included in reference (5) are instructions on the following:

(a)sample handling practices and chain of custody,

(b)reagents and standards procurement and control,

(c)calibration procedures and frequency,

(d)analytical procedures,

(e)document control,

(f)internal quality control,

(g)data evaluation and data reduction,

(h)performance and system audits including accreditation's,

(i)preventive maintenance,

(j)routine procedures to assess accuracy, precision, and completeness, and

(k)out-of-control events and corrective actions.

2.1 Technical Analytical Expertise

Reference (5) delineates the personnel training and qualification requirements. The Laboratory Qualification Plans (QPs) outline the analysts' training requirements to achieve and demonstrate proficiency for each type of analytical method.

2.2 Effective Information Management Systems

Reference (5) provides the instruction to ensure proper handling of samples from receipt to the completion of the analytical process. These procedures ensure all associated documentation, including sample analysis requests, are complete and consistent with samples received and the sample integrity is maintained.

3. Selecting Testing and Analytical Methods

3.1 The Shipyard has a number of mixed waste streams with varying physical and chemical properties. Proper selection of laboratory testing and analytical methods is critical to ensure waste designation using compliance testing and analysis is accurate and fulfills regulatory requirements.

3.2 Table A-2 provides a list of the standard analytical methods used by Code 134 to perform compliance testing for various parameters. The list gives the sampling requirements for optimum sample analysis and quality control. Contact Code 134 for information on other test methods available at the Shipyard Laboratory. For cases where the listed requirements are not practical or applicable, contact Code 134 to determine what alternative sampling parameters are allowed. Code 134 is required to concur with any procedure or sampling plan that specifies tests or sampling requirements that deviate from Table A-2.

3.3 If the Shipyard Laboratory cannot perform a required analytical procedure Code 134 will determine if the analytical procedure should be added to their capabilities or accomplished by a contracted off-site laboratory.

3.4 All compliance analyses will have detection limits consistent with regulatory requirements.